ELAN-104

PC-Compatible PC/104 Board

Technical Manual

Product Information

Product Information
Full information about other Arcom PC/104 products is available via the FaxBack System, (Telephone Numbers listed below), or by contacting our Website at:
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Warning

Handling

This board contains static sensitive devices. Observe anti-static precautions at all times. Unpacking and installation of the board should be undertaken in an anti-static working area.

Battery

Note: The board is supplied with the battery isolated. Move Link3 to position A before using the board.

The board is fitted with a lithium non-rechargeable battery. Do not short circuit the battery or place the board on a metal surface where the battery terminals could be shorted.

Dispose of the battery with care. Do not incinerate, crush or otherwise damage the battery.

Electromagnetic Compatibility (EMC)

The ELAN-104 is compliant with the requirements of the EMC Directive when operated in a suitable enclosure, such as the Arcom ACEpc, and with suitable screened cables for the keyboard and COM ports.

The standards which have been applied are:

BS EN50081-1	: Generic Emissions standard, residential.
BS EN55022 Class.B	: ITE emissions standard Class B.
BS EN50082-1	: Generic immunity standard, residential.

Acknowledgements

Arcom Flash Filing System (AFFS), is the generic name given to the ported Flash Filing System called Cardtrick™. *Both Cardtrick and ROM-DOS 6.22 are trademarks of Datalight Inc.* Each ELAN-104 includes two small license labels to identify the installed Datalight product. Do not remove.

Revision History

Manual	PCB	Comments
Iss A	V1I2	First full release of Manual

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Introduction

The ELAN-104 is a PC-compatible processor board based on the 100MHz AMD ELAN SC400 486SX microcontroller. The board can be configured using the BIOS and AMD ELAN SC400 Microcontroller registers to implement different levels of power management depending on the application. The board is ideal for low-cost medium-scale Man-Machine Interface applications. There are connections available for VGA CRT or LCD, Mono LCD Graphics, PC AT keyboard and Matrix keypad up to 8 x 8 in size.

The board is supplied with a up to 8Mb of On-board Flash memory that is configured as a Flash Drive using Arcom Flash filing System (AFFS). ROM-DOS 6.22, a low-cost 'work-alike' of MS-DOS 6.22 is pre-loaded onto the Flash drive.

The ELAN-104 has a 16-bit Master only PC/104 interface which supports a wide range PC/104 modules including Arcom's AIM104 range.

On-board peripherals include COM1 and COM3 (RS-232), COM2 (RS-485), a floppy disk controller, hard disk (IDE) controller, a parallel port (LPT1) and PS/2 mouse interface.

Variants

ELAN-104-100-M4-F4	*4Mb DRAM*	*4Mb Flash*	*SVGA*
ELAN-104-100-M8-F4	*8Mb DRAM*	*4Mb Flash*	*SVGA*
ELAN-104-100-M16-F4	*16Mb DRAM*	*4Mb Flash*	*SVGA*
ELAN-104-100-M16-F8	*16Mb DRAM*	*8Mb Flash*	*SVGA*
ELAN-104-100-M4-F4-NV	*4Mb DRAM*	*4Mb Flash*	*No SVGA*

Features

- AMD Elan-SC400 100MHz 486 Processor, including:
  - 8-Kb write-back cache
  - Dual DMA controllers (8237)
  - Dual Interrupt controllers (8259)
  - Programmable Interval Timer (8254)
- 4, 8 or 16Mb DRAM
- 4 or 8Mb Flash Memory
- 128Kb of battery backed SRAM memory
- COM1 & COM3 RS232 Serial ports via individual 9-way D-type plugs
- COM2 RS485 Serial port via a vertical 10-way header
- Includes ROM-DOS 6.22
- Includes Arcom Flash Filing Systems (AFFS)
- FDD interface via a vertical 34-way boxed header (up to 2 drives)
- HDD IDE interface via a vertical 40-way boxed header (up to 2 drives)
- LPT Bi-directional parallel port via a vertical 26-way boxed header
- Battery backed PC-AT compatible Real Time Clock (146818)
- AT keyboard interface via a 6-way 'Mini' DIN PS/2-style socket
- Mouse interface via a PS/2 style socket
- 64 key Matrix keypad and 640x480 Mono LCD interface via a 40-way 2mm pitch header
- S-VGA CRT/LCD controller. 1Mb VDRAM supports both CRT (16-way boxed header) and Flat Panel (40-way 2mm pitch header), up to 1024x768.
- User Link
- Battery Level Sense connections via a 5-way header
- Software enabled Watchdog generating a reset or software configurable interrupt
- External Reset switch via a 2-way header
- PC/104 Interface, 16-bit, Single Master only
- Speaker Connection via a 2-way header
- Single Eurocard form factor: 100mm (H) by 160mm (L)
- Phoenix Pico BIOS
- IDE Status LED
- Integrated Power Management

Arcom also manufacture a range of PC/104 modules for use with the ELAN-104. These include opto-isolated digital and analogue I/O, relay output, CAN interface, multi-port serial communications and ethernet. Data sheets and manuals are available from the Arcom website or the Fax-on-Demand service (see front of manual).

Getting Started with the ELAN-104

Initial Configuration

Battery back-up is necessary to maintain the BIOS settings. If the battery back-up voltage is not present then the ELAN-104 will revert to its default settings following any power-down. The battery link LK3 is isolated during shipment and needs placing in position A to enable the battery back-up facility. If the battery back-up is to be supplied from an external source instead of the on-board battery then connect the positive voltage from the backup supply (which must be between +2.8v and 6.0v) to VBAT and the ground to GND on PL5.

Connect a +5V power supply to the power header PL5. The ELAN-104 does not require ±12v to operate and does not have an on-board ±12v generator so if any of the PC/104 boards connected to the ELAN-104 require +12v or -12v power (such as the AIM104-SER4) these voltages must be connected to PL5. Refer to the labelling on the board or Appendix A for correct connections.

A keyboard and a VGA monitor should be used with the ELAN-104 initially to form a minimal PC system. This will allow any development and set-up to be carried out easily. A standard PC-AT keyboard can be connected using the keyboard adapter cable supplied with the board. A VGA monitor can be connected to the 16-way VGA header using the VGA adapter cable.

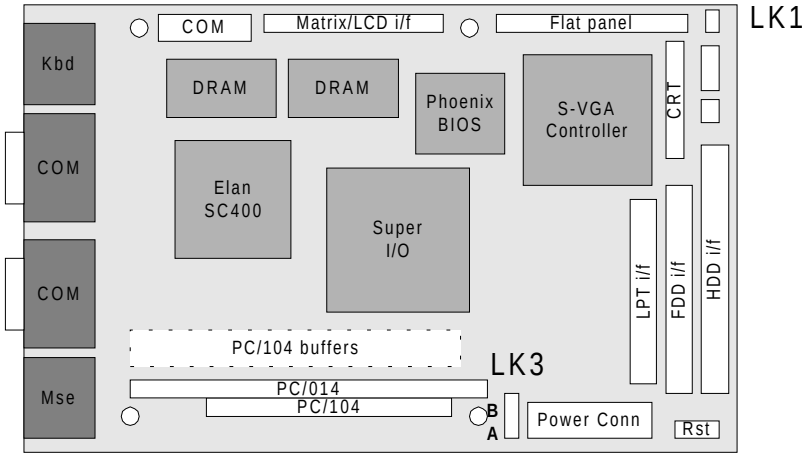
The BIOS set-up screen can be entered by pressing F2 when prompted. The BIOS utility allows you to configure the ELAN-104 for any additional drives, security options advanced features and power management. More information on the PICO BIOS and setup options can be found on the CD-ROM.

ELAN-104 Development Kit

Arcom provide a comprehensive development kit containing all the necessary cables for a PC configured system and a range of documents and software utilities that show how to configure the more advance features of the ELAN-104.

- 34-way Floppy drive twisted ribbon cable
- 40-way Hard drive ribbon cable
- CD-ROM containing the complete manuals for the AMD ELAN SC400 Microcontroller and the SMCS FDC37932 Super I/O Controller
- Application notes for the LCD and matrix interface, VGA flat panel interface and Power Management modes.

Links and Hardware Options



Link Settings

LK1 User Link (described in On-board Features)
Fitted - Elan GPIO register reads 0
Not Fitted - Elan GPIO register reads 1

LK3 Battery Back-Up Link (to external battery or on-board battery)
Position A - Connected
Position B - Isolated

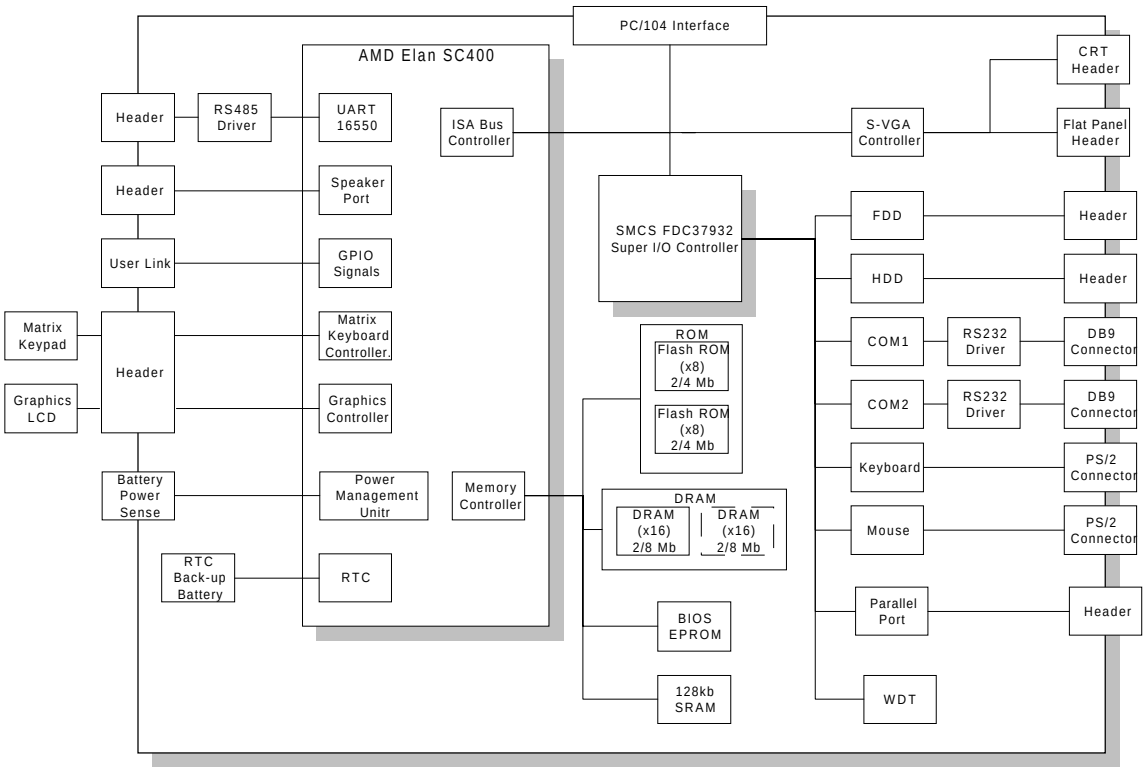
Note : All other links are factory fitted.

Using the ELAN-104

Overview

The ELAN-104 is a PC compatible processor board. There are connections on the ELAN-104 for a keyboard, mouse, floppy drive, a hard drive, and it features three serial ports and a centronics parallel port. Additional PC/104 modules can be connected to the ELAN-104 via the 16-bit PC/104 connector to form a configured Industrial PC system. Various displays and keypads can be connected to the ELAN-104 using the VGA/CRT 16-way, VGA/LCD 40-way interface, Mono LCD and Matrix Keypad 40-way interface.

Block Diagram



The ELAN-104 is based around the AMD SC400 Microcontroller. This part provides the PC-AT architecture of the board. Most of the peripheral interfaces are provided by the AMD SC400 or the SMSC FDC37C932 Super I/O

The ELAN-104 board is designed for diskless operation and is supplied with Arcom Flash Filing System (AFFS) and ROM-DOS 6.22 pre-loaded. AFFS allows the Flash memory on the ELAN-104 to be accessed as a normal drive. ROM-DOS is a flexible, small and fast compatible DOS. A full ROM-DOS users manual is supplied on the accompanying CD-ROM. More information on ROM-DOS can be found on the Datalight website (www.Datalight.com).

Using AFFS the on-board Flash memory appears exactly as a normal hard drive interface. All application software can be loaded onto the Flash and run exactly as if were a standard hard drive. There is no need to configure the on-board Flash memory in the BIOS set-up utility as AFFS will automatically configure the Flash as the C:\ drive unless a hard drive is connected in which case the AFFS drive will be moved up to the next available drive letter.

AFFS operated using a BIOS extension to create a Flash drive at boot time. The Flash drive is fully bootable.

NOTE: Any additional drives connected to the IDE connector will be allocated as the C:\ drive. When adding a hard drive to the ELAN-104 the hard drive should be configured as the C:\ drive in the BIOS set-up. The AFFS will then reallocate Flash drive as the D:\ drive or the next available drive letter.

AMD SC400 Microcontroller

The ELAN-104 is fitted with an AMD ELAN SC400 microcontroller. The AMD part combines a 32-bit low-voltage Am486 CPU with a complete set of PC/AT-compatible peripherals, along with sophisticated power management features. It includes the following characteristics:

- 33-Mhz, 66-Mhz and 100-Mhz operating frequencies
- No floating point unit
- 8-Kbyte write-back cache for enhanced performance
- Seven modes of operation allow fine-tuning of power requirements

The AMD ELAN-SC400 has many internal configuration registers that can be used to configure the ELAN-104 board. These registers are used to configure features on the board including the Power Management, Keypad, Mono LCD Display, User Link, and the video power-down mode.

Several relevant registers are described below. For more information about how to use the AMD ELAN-SC400 parts it necessary to obtain the user and register manuals. These are provided as part of the development kit or they can be down-loaded from the AMD website (see references).

The registers are accessed using a poi nter-index scheme. Most of these registers can be accessed by writing the register index address to I/O port 22h and then reading or writing the data to I/O port 23h.

AMD SC400 Power Management

Power management can be implemented in various ways depending on the final application requirements. There are five main approaches to power managing the ELAN-104 board. All the power management modes are controlled from within the AMD SC400 Power Management Unit (PMU). To implement any of the following schemes apart from the BIOS set-up it is necessary to refer to the AMD SC400 manuals.

- BIOS set-up facility.
- OS Driven - Using the OS (e.g. Windows 95)to force the ELAN-104 into various states using APM compatibility.
- Automatically- application software sets up time outs and activity sources and then PM works invisibly.
- Software Driven - application software forces the ELAN-104 registers to different power states as required.
- Battery Sense - The PMU controls the power states to reduce the risk of completely exhausting the power supply batteries.

BIOS Set-up
The BIOS set-up utility, which can be accessed by pressing DEL during the initial power up, has several options incorporated into it which can be configured to activate several standard power management features such as default processor speed, standby mode, idle mode and suspend mode time-outs. These can be accessed by selecting the POWER menu when in the set-up window. The various modes perform the following power management functions:

- Normal operation - the board operates at the maximum processor speed defined in the BIOS set-up. This is the hyper speed mode. The default value for this is 100Mhz
- Idle - the PMU changes to a lower speed mode. The processor speed is now restricted to 33Mhz (default value).
- Standby - The processor speed is reduced further and various functions are disabled including the screen.
- Suspend - The processor clock is stopped completely.

OS Driven
The ELAN-104 has peripherals and power management capabilities which an OS such as Windows 95 can control automatically to implement various power save features such as powering down hard drives and suspend mode.

Automatic mode
Fully automatic mode allows extensive power management operations to be performed completely transparent to the software application. In this mode wake-ups and activities move the AMD SC400 Power Management Unit (PMU) to higher/lower performance states. All the individual performance states/modes can be configured with a time-out that will force the PMU to lower performance modes if there is inactivity. Software defined activities return the SC400 to high performance states. Software defined wake-ups returns the SC400 from suspend state.

Software Driven
This mode is similar to automatic mode except that the application software forces the PMU into different modes instead using time-outs. Here the application software provides intelligent power management at the system level.

Battery Level Sense
The ELAN-104 has a 5-way Power Sense header which can be configured in various ways to monitor the status of the external power supply to the board. The power management unit (PMU) within the AMD SC400 Microcontroller can be configured to switch the board into different power saving modes depending on the state of these connections. Battery Sense should be used when maximum performance is the main criteria of the system. In this scheme the ELAN-104 will operate at maximum speed unless the main power supply to the system is disconnected (detected by ACIN) in which case it will go to a lower power management mode (e.g. Suspend) and work from the battery supply. The PMU can be configured using the SC400 registers to sense the other inputs (/BL1 and BL2) to determine the battery level and then move to even lower modes (e.g. critical suspend) if the battery is critically low.

Four signals are brought into the microcontroller from the power sense header so that the state of the system power can be reported to the microcontroller and used in the power management scheme.

ACIN Input
The Alternating Current INput (ACIN) signal indicates that the system is connected to a greater power source (such as an AC wall plug) and that power savings are no longer as important as performance. This signal causes the ELAN-104 to run at the highest mode available depending on the configuration of the PMU.

Battery Low Inputs (/BL1 and /BL2)
The battery low signals (/BL1 and /BL2) are digital inputs that external voltage comparators or an external processor can drive to inform the microcontroller of the state of the charge on the system batteries. Each of these signals can report a different level of battery discharge depending on how they are configured. For example they may be used as follows:

/BL1 - Batteries are going weak, so slow the speed of the board
/BL2 - Batteries are so weak that they cannot operate the board. Force the ELAN-104 into critical suspend mode.

SUS-RES Input
The SUS-RES pin is an input to the board that can be configured using the SC400 registers as a Suspend and/or Resume input. This allows an external signal to force the power management unit on the ELAN-104 into and out of Suspend mode. This pin is configured using two registers within the AMD SC400.

NOTE: Both of the battery Low signals are pulled-up on the ELAN-104 so that no connections to this header are necessary if the function is not needed.

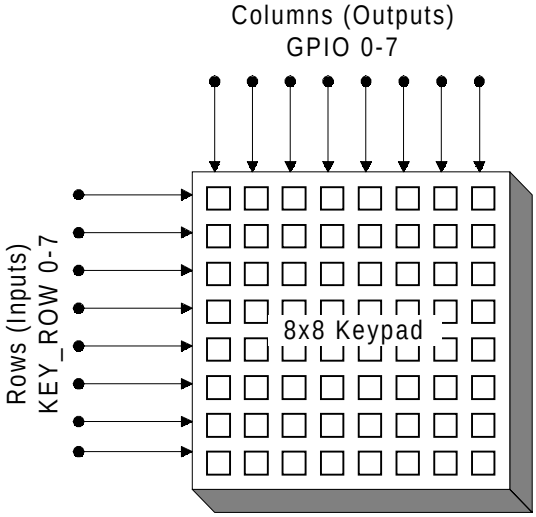
There is another battery low signal available on the AMD SC400 part, /BL0, but this has been configured to generate the PC/104 bus clock on the ELAN-104. This allows the power management unit to be configured to disable the ISA bus if necessary.

There are several registers used to configure the battery sense function. Refer to the AMD SC400 manuals for description of the register functions.

Matrix Keypad

The Matrix keypad connector allows keypads upto 64 keys (8x8) to be interfaced to the ELAN-104. The connector has 8 keypad row signals and 8 General Purpose I/O (GPIO) (which should be configured to act as columns) signals available. The AMD SC400 registers allow these signals to be configured as the required number of rows and columns.

A keypad works by asserting each column to a known state and then scanning the row input lines to see which of the keys has being pressed.



The keypad can be configured in many different ways using the keypad rows and the GPIO pins. The utilities disk contains a sample piece of C code to illustrate how a typical matrix 8x8 keypad can be integrated to the system using the following registers. Please refer to the AMD manuals for more information about how to configure these pins in different ways.

Note: The pinout numbering on the connector is not the same as the descriptions in the AMD SC400 documentation. GPIO 0-7 on the connector correspond to GPIO 24-31 on the AMD part. The KEY_ROW pins only differ in that KEY-ROW7 is actually the SC400 KBDROW12.

GPIO Read Back/Write Register
I/O Address 22h/23h
Index A9h

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GPIO 7 Status	GPIO 6 Status	GPIO 5 Status	GPIO 4 Status	GPIO 3 Status	GPIO 2 Status	GPIO 1 Status	GPIO 0 Status

The state of the pins GPIO 0 - GPIO 7 can read using this register.

GPIO Function Select Register F
I/O Address 22h/23/h
Index A5h

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GPIO 7 Input/ Output	GPIO 6 Input/ Output	GPIO 5 Input/ Output	GPIO 4 Input/ Output	GPIO 3 Input/ Output	GPIO 2 Input/ Output	GPIO 1 Input/ Output	GPIO 0 Input/ Output

The GPIO pins can be individually configured as inputs or outputs. The method illustrated here requires all the GPIO pins to be inputs.

0 - Input
1 - Output

GPIO Termination Control Register A
I/O Register 22h/23h
Index 3Eh

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
GPIO 7	GPIO 6	GPIO 5	GPIO 4	GPIO 3	GPIO 2	GPIO 1	GPIO 0

Each of the GPIO pins provide has a software configurable pull up resistor. The pins GPIO 0 - GPIO 7 should be configured to either enable or disable the pull resistors on each of these pins.

1- Enable pull up resistor
0 - Disable pull up resistor

KeyPad Row Register A
I/O Address 22h/23/h
Index C8h

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	KEY_ROW 6	KEY_ROW 5	KEY_ROW 4	KEY_ROW 3	KEY_ROW 2	KEY_ROW 1	KEY_ROW 0

Writing to this register will set the appropriate pins high or low.

KeyPad Row Register B
I/O Address 22h/23/h
Index C9h

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Reserved	KEY_ROW 7	Reserved	Reserved	Reserved	Reserved

Writing to this register will set the appropriate pins high or low.

Note: Any software accesses should be structured in a way so that RESERVED bits are unaffected. These bits are used to configure other functions of the ELAN-104

MONO LCD Controller

The MONO LCD graphics controller is integrated within the AMD SC400 Microcontroller and will support LCD displays up to 640x480 dual-scan. The graphics controller includes the following features:

- Supports single-scan or dual-scan monochrome LCD panels with 4- or 8-bit data interface
- Supports single-scan colour Super Twisted Nematic (STN) panles with 8-bit interface, same resolution as monochrome mode
- 40, 64, or 80 columns with 16, 10 , or 8 pixels wide
- Variable height characters up to 32 lines
- Variable width characters 8, 10 or 16 pixels
- MDA Monochrome or CGA 4 gray shades, 16 grey shades or 16 colours
- The following graphics mode features are supported
  640x200 1 bit-per-pixel, CGA-compatible buffer memory map
  320x320 2 bits-per-pixel, CGA-compatible buffer memory map
  640x480 2 bits-per-pixel, flat memory map (lower resolutions supported)
  640x480 1 bit-per-pixel, flat memory map
- 1, 2 or 4 bits-per-pixel packed-pixel flat-mapped graphics up to 640x240/480x320 with mapping modes:
  - 16-Kbyte window with bank swapping to address up to 64 Kbytes of graphics frame buffer while consuming only 16 Kbytes of DOS/Real-mode CPU address space
  - Direct-mapped (no bank swapping) with locatable base address, up to 128 Kbyte direct addressability

The AMD SC400 registers must be configured to support each individual LCD display depending on their characteristics. Configuring the ELAN-104 for individual MONO LCD displays is highly specific to the display and reference should be made to the AMD SC400 manuals.

User Link and VGA Power-Down

I/O ports 22h & 23h Index register A7h

The user link and VGA power-down are accessed through the Chip Set-up and Control I/O ports at 22h and 23h. Port 22h should be written to specify the index register. Data can then be read from or written to the specified configuration register via direct-mapped port 23h.

The status of the user link can be read from index register A7h. The status of the video power-down can be set using index register 47h.

The VGA Power- Down works by placing the 65545 VGA controller chipset into Suspend mode. This will have no effect on the Mono Graphics display which is controlled by the AMD SC400 Microcontroller.

VGA Power Down and User Link Register
I/O Address 22h/23h
Index A7h

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VGA Power-Down	User Link Status	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used

VGA Controller Power Down 0 - Power-Down Disabled
1 - Power-Down Enabled
User Link Status 0 - Link Fitted
1 - Link Omitted

SMCS FDCC932 Super I/O Device

The Super I/O chip (SMCS FDC37932) device is used to implement most the I/O ports on the ELAN-104.

Features

- 8042 Keyboard and Mouse Controller
- Intelligient Auto Power Management
- 2.88MB Super I/O Floppy Disk Controller
- Two High Speed 16C550 Compatible UARTS (COM1 and COM3)
- IDE Interface
- Multi-Mode Parallel port.
- Watchdog Timer

The device can be configured to a limited extent during running operation. To gain access to all the configuration registers it is necessary to force the Super I/O device into a configuration state. Entering and leaving this state is straightforward. To obtain more details on how to alter the configurations of the Super I/O device it is necessary to refer to the User Manual which can be found on the development kit CD or on the SMCS website.

The Super I/O part has internal configuration registers that are used to all configure I/O devices shon above. The on-board Watchdog timer is implemented within this device and needs to be configured using these registers also.

Warning: Changing these registers may cause the ELAN-104 to function incorrectly.

VGA CRT/LCD Controller

The Elan-104 uses a Chips and Technologies High performance Flat Panel VGA 65545 CRT/LCD Controller chip and 1Mbyte of VDRAM to implement a CRT and LCD flat-panel interface. The utilise disk contains video drivers for the 65545 video controller for DOS, Windows 3.1, Windows 95 and Windows NT 4.0.

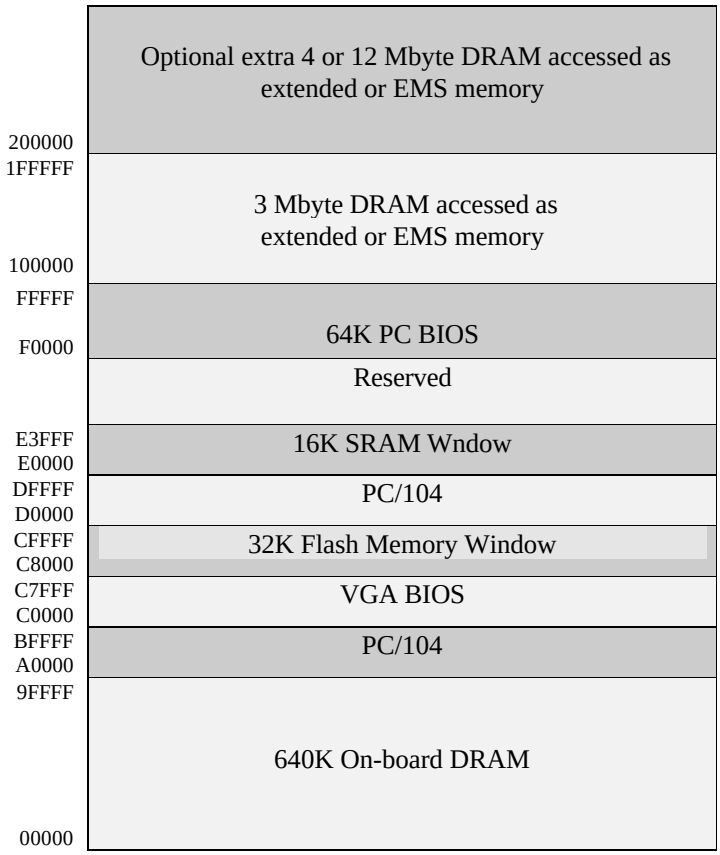
This VGA interface supports:

- Upto 1024x768 on both the CRT and LCD interfaces
- True Color and Hi-Color display capability with flat panels and CRTmonitors upto 640x480 resolutions
- Panel-Off Power-Saving-Mode implemented through the AMD SC400 Microcontroller registers

The ELAN-104 comes with a VGA D-type converter cable to connect between the 16-way header and a standard VGA monitor connector. The 40-way VGA LCD header provides all the necessary signal to allow various flat panels to be connected to the ELAN-104. For connection details refer to the LCD Flat-Panel manufacturer or contact Arcom Technical Support.

The Video BIOS will need to be re-configured for different flat-panels. For more information about re-configuring the Video BIOS please contact Arcom for a list of support panels.

Memory Map



I/O Map

03F8h-03FFh	On-Board COM1		Super I/O
03F7h 03F0h	On-Board Floppy Disk	Super I/O Configuration Port	Super I/O
03E8h-03EFh	On-Board COM3		Super I/O
03E0h-03E1h	PC Card Index, Data		AMD SC400
03B0h-03DFh	VGA Control Registers	LCD Gaphics Controller CGA (non-VGA)	Chips 65545 (or AMD SC400)
0378h-037Fh	Parallel Port LPT1		Super I/O
	Available for Slave I/O Boards		PC/104
02F8-02FF	On-Board COM2		AMD SC400
	Available for Slave I/O Boards		PC/104
0208h-0219h	EMS Page Registers		
	Available for Slave I/O Boards		PC/104
01F0h-01F7h	On-Board IDE Controller		Super I/O
	Available for Slave I/O Boards		PC/104
0100h	Reserved I/O Space		
0022h-0023h	Chip Setup and Control (CFC)		AMD SC400
0000	Reserved I/O Space		

IRQ Map

IRQ0	Tick Timer
IRQ1	Keyboard
IRQ2	Interrupt Controller 2
IRQ3	COM3
IRQ4	COM1
IRQ5	Free
IRQ6	Floppy Disk
IRQ7	Parallel Port
IRQ8	RTC
IRQ9	Free
IRQ10	COM2
IRQ11	Free
IRQ12	PS/2 Mouse
IRQ13	Free
IRQ14	IDE Drive
IRQ15	Free

Note: The three COM port interrupts are arranged differently to a normal PC due to the architecture of the AMD ELAN SC400 microcontroller.

Additional On-Board Features

RS485

COM3 on the ELAN-104 is provided by a 16550- compatible serial port buffered to RS485 levels. The half-duplex signals available are RX/TX+, RX/TX- and GND. Please refer to the appendix for pinouts. The maximum line length allowable for the RS-485 standard is 1300 metres. The combined impedance of a driver output and receiver allows up to 32 transceivers on the bus. The wire ends of a RS-485 bus must be terminated with a resistor equal to their characteristic impedance, typically 100Ω. The ELAN-104 has a 100Ω resistor fitted as standard and should normally be placed at the end of the RS-485 bus. The half-duplex operation is controlled by the RTS handshake line.

System BIOS

The ELAN-104 is fitted with a Phoenix PICO BIOS on a 128K Flash EPROM. This compressed BIOS includes the BIOS extension for the AFFS Flash drive and the Video BIOS. A user manual is included on the development kit CD-ROM. This describes the available functionality of the generic BIOS. The ELAN-104 implements most of the basic functions but there will be certaina omissions due to the hardware architecture of the board.

Reset

PL14 is a 2-way header for an external push button reset switch. When this connection is shorted only the CPU is reset. The Am486 Cache state is not effected. This is equivalent to a 'soft' reset.

IDE LED

LED1 which is located by the keyboard connector is a small surface mount LED which is used to indicate accesses to the IDE port of the ELAN-104. The LED will produce will a short flash for every access to the drive. This LED will not indicate accesses to the Flash drive on-board.

External Speaker

PL5 is a 2-way header that allows an external speaker to be connected to the board. The drive circuit consists of the speaker in series with a 34Ω resistor at the drain of a 2N7002 FET (refer to the circuit diagram). The FET will sink upto 115mA.

SRAM

The ELAN-104 has a 128Kb SRAM device on-board. This device can be used as a high speed drive by using the device driver SRAMDRIVE.SYS which can be found on the CD-ROM. The SRAM is battery backed by the on-board battery. An external battery can be connected if a greater back-up time is required.

AFFS

The ELAN-104 is fitted with the Arcom Flash Filing System as standard. This organises the on-board Flash memory so that it appears as a normal hard drive. There is a complete copy of AFFS on the utilities disk which can be used to install AFFS if necessary.

The AFFS will always install the Flash drive as drive C:\ unless an additional drive (IDE, CD-ROM or otherwise) is connected in which case it will be allocated to the next highest letter.

ROM-DOS 6.22

ROM-DOS 6.22 is pre-installed on the AFFS Flash drive of the ELAN-104. ROM-DOS is a small compatible workalike version of MS-DOS 6.22, but also has many additional embedded features such as Remote Disk which can be used to download files to the ELAN-104 using a serial communications link. The complete ROM-DOS users manual and all the additional ROM-DOS utilities have been included on the utilities disk supplied with the ELAN-104. The user manual is a self-extracting file called RDUSER.EXE.

PS/2 Mouse

SW3 is a PS/2 style mouse connection which is located next to the COM3 D-type. The pinout for this (described in the appendix A) allows a standard PS/2 mouse to be connected to the board.

PS/2 Keyboard

SK1 is a PS/2 style keyboard connection which is located next to the COM1 D-type. Using the supplied PS/2 adapter cable a standard PC AT Keyboard can be connected to the ELAN-104 to help form a complete PC system. The pinout for this connector can be found in appendix A.

External Battery

The on-board battery on the ELAN-104 provides battery back-up to the board for a period of 15,500hours. Some applications may require a longer period than this to ensure that the CMOS configuration data for the board does not become corrupted In these cases a larger capacity external battery supply can be connected to the ELAN-104 at the power header PL13 at the screw terminal market +VBAT. The external battery must provide a voltage between than +2.8v and +6.0v at PL13.

SAVECMOS Utility

The utilities disk contains the file SAVECMOS.EXE. The utility is used to safe-guard the CMOS settings of the ELAN-104, which are used to store the time/date information and hardware settings (e.g. hard drive parameters), in case of a on-board battery failure. If the on-board battery goes flat or is damaged in any way the CMOS settings will become corrupted and the board may function incorrectly following a power-down state. SAVECMOS performs two functions. First, it should be used to save the current CMOS memory information to a file. Then the utility can be used to compare the CMOS memory settings to this file. If they are different it will update the CMOS settings in memory.
If SAVECMOS is put in the AUTOEXEC.BAT file of the ELAN-104 it will be run every time the ELAN-104 is booted so guaranteeing that a particular group of CMOS settings are always used. For more information on the syntax used run the SAVECMOS help menu by typing:

```
SAVECMOS/?
```

Watchdog

The Watchdog timer on the ELAN-104 is software-enabled and generates a ‘soft’ reset where only the CPU is reset (exactly like the push-button reset). The watchdog function is provided by the Super I/O chip on the ELAN-104 board. This can be software initialised as described earlier.

User Link

The user link LK1 can be read through the AMD ELAN-SC400 processor registers. This is described earlier. With the link fitted the user link status will be zero, and with it not fitted it will return a one.

Utilities Disk

The utilities disk provided with the board includes the following:

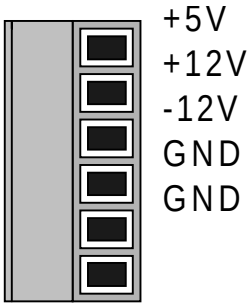
- All the necessary Arcom Flash Filing System files
- All the ROM-DOS 6.22 utilities
- SAVECMOS - a utility to back-up the ELAN-104 in case of battery failure
- SRAMDISK.SYS - a device driver to use the SRAM as a high speed read/write drive
- ROM-DOS.DOC - Comparative review of ROM-DOS 6.22 and MS-DOS 6.22 and a list additional commands
- RDUSER - Self-extracting ROM-DOS users manual

APPENDIX A - Connections

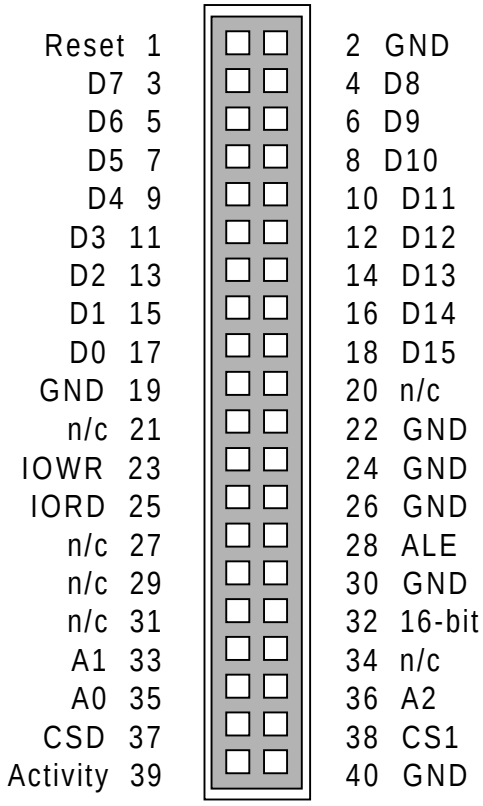
Power Connections

The board only requires +5v for normal operation. If however any additional PC/104 modules are fitted +/-12v may also be required. There is no on-board +5v to +/-12v converter. These should be connected to the plug-in terminal block of PL13 as shown. The board typically requires 1A with no power saving features active.

An external battery back-up voltage BAT can be connected to the board also at PL13. The external voltage used should be greater than 2.8v. The average drain current is 11uA.

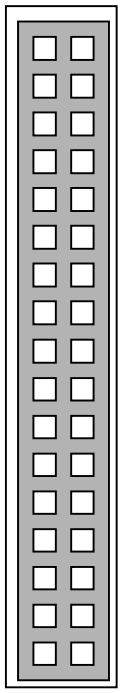


40-way IDE HDD Connector



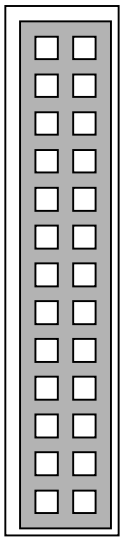
34-way Floppy Disk Drive Header

A standard PC-type twisted floppy drive cable is needed when connecting a drive to the ELAN-104.



GND	1	2	/DRVDEN0
GND	3	4	n/c
GND	5	6	/DRVDEN1
GND	7	8	/Index
GND	9	10	/Motor 0
GND	11	12	/Drive 1
GND	13	14	/DRV0
GND	15	16	/DRV1
GND	17	18	Direction
GND	19	20	/Step
GND	21	22	/Write Data
GND	23	24	/Write Gate
GND	25	26	/Track 0
GND	27	28	/Write Protect
GND	29	30	/Read Data
GND	31	32	Head Select
GND	33	34	Disk Changed

26-way LPT Parallel Port Header



Strobe	1	2	Low Current
D0	3	4	n/c
D1	5	6	n/c
D2	7	8	/Index
D3	9	10	GND
D4	11	12	GND
D5	13	14	GND
D6	15	16	GND
D7	17	18	GND
ACK	19	20	GND
BUSY	21	22	GND
Paper End	23	24	GND
Printer Selected	25	26	VCC

PC/104 Interface

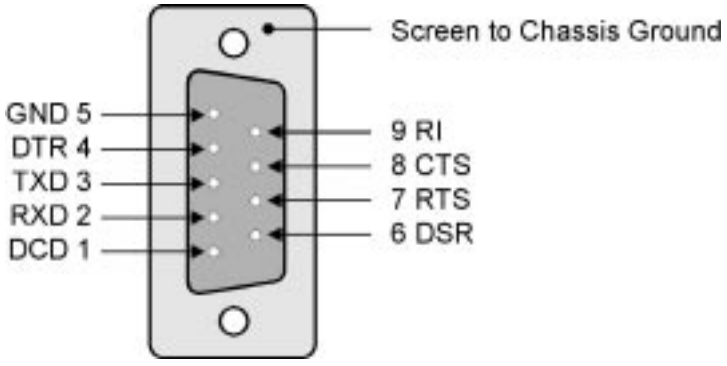
Both 8-bit and 16-bit modules can be fitted to the ELAN-104. The board complies with the PC/104 specification with the exception that the MASTER* signal line is not implemented on the 40-way connector. The ELAN-104 is therefore the only master allowed in the system.

Care should be taken when installing modules, especially 16-bit types. Ensure that all the pins are correctly aligned with the sockets on the ELAN-104 before pushing home. The module should then be secured with the fixing kit provided.

Pin Number	Row A	Row B	Row C	Row D
0	-	-	0V	OV
1	IOCHCHK	OV	SBHE*	MEMCS16*
2	SD7	RESETDRV	LA23	IOCS16*
3	SD6	+5V	LA22	IRQ10
4	SD5	IRQ9	LA21	IRQ11
5	SD4	-	LA20	IRQ12
6	SD3	-	LA19	IRQ15
7	SD2	-12V	LA18	-
8	SD1	ENDFXR*	LA17	DACK0*
9	SD0	+12V	MEMR*	DRQ1
10	IOCHRDY	-	MEMW*	DACK5*
11	AEN	SMEMW*	SD8	DRQ5
12	SA19	SMEMR*	SD9	DACK6*
13	SA18	IOW*	SD10	DRQ6
14	SA17	IOR*	SD11	DACK7*
15	SA16	DACK3*	SD12	DRQ7
16	SA15	DRQ3	SD13	+5V
17	SA14	DACK1*	SD14	-
18	SA13	DRQ1	SD15	0V
19	SA12	REFRESH*	-	0V
20	SA11	SYSCLK	-	-
21	SA10	IRQ7	-	-
22	SA9	-	-	-
23	SA8	IRQ5	-	-
24	SA7	IRQ4	-	-
25	SA6	IRQ3	-	-
26	SA5	-	-	-
27	SA4	TC	-	-
28	SA3	BALE	-	-
29	SA2	+5V	-	-
30	SA1	OSC (14.318MHz)	-	-
31	SA0	0V	-	-
32	OV	0V	-	-

RS-232 COM1 and COM3

Standard pin-out RS-232 serial communications are provided on COM1 and COM3.

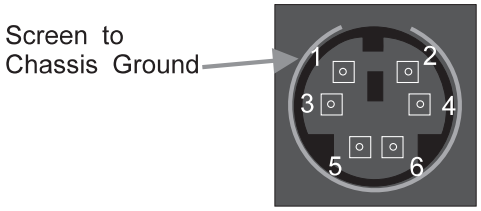


RS485 COM2

The 10-way header PL1 provides half-duplex RS485 serial communications It also brings out connections for an IrDA interface (SIRIN and SIROUT) as an alternative function to the RS485.

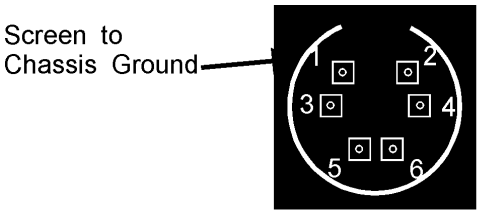
SIRIN	1		2	SIROUT
FGND	3		4	FGND
RX/TX+	5		6	RX/TX-
FGND	7		8	F+5V
FGND	9		10	NC

PS/2 Keyboard



1 Keyboard Data
2 n/c
3 GND
4 +5V
5 Keyboard Clock
6 n/c

PS/2 Mouse

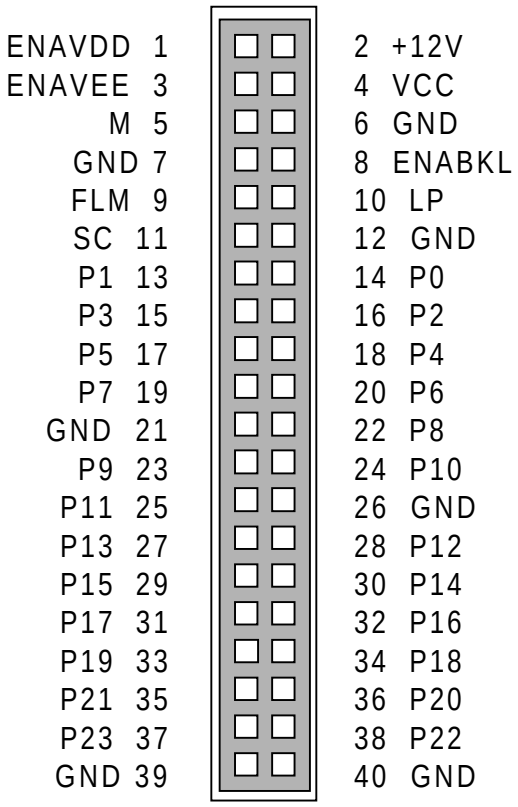


1 **Mouse Data**
2 n/c
3 GND
4 +5V
5 **Mouse Clock**
6 n/c

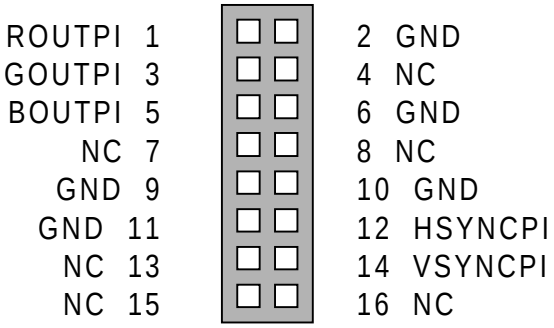
Matrix keypad and MONO LCD Flat Panel

XTDATA	39		40	XTCLK
LVDD	37		39	LVEE
SCK	35		36	LC
M-SC400	33		34	FRM
GND	31		32	VCC
LCD6	29		30	LCD7
LCD4	27		28	LCD5
LCD2	25		26	LCD3
LCD0	23		24	LCD1
GND	21		22	VCC
KEY_ROW6	19		20	KEY_ROW7
KEY_ROW4	17		18	KEY_ROW5
KEY_ROW2	15		16	KEY_ROW3
KEY_ROW0	13		14	KEY_ROW1
GND	11		12	VCC
GPIO6	9		10	GPIO7
GPIO4	7		8	GPIO5
GPIO2	5		6	GPIO3
GPIO0	3		4	GPIO1
GND	1		2	VCC

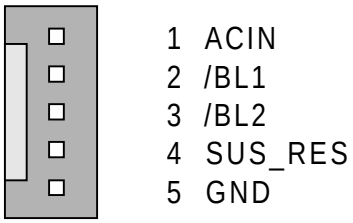
VGA LCD Flat Panel



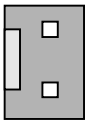
VGA CRT



Battery Level Sense

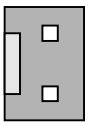


Ext Speaker



1 +5V
2 SPKRDRV

Ext Reset

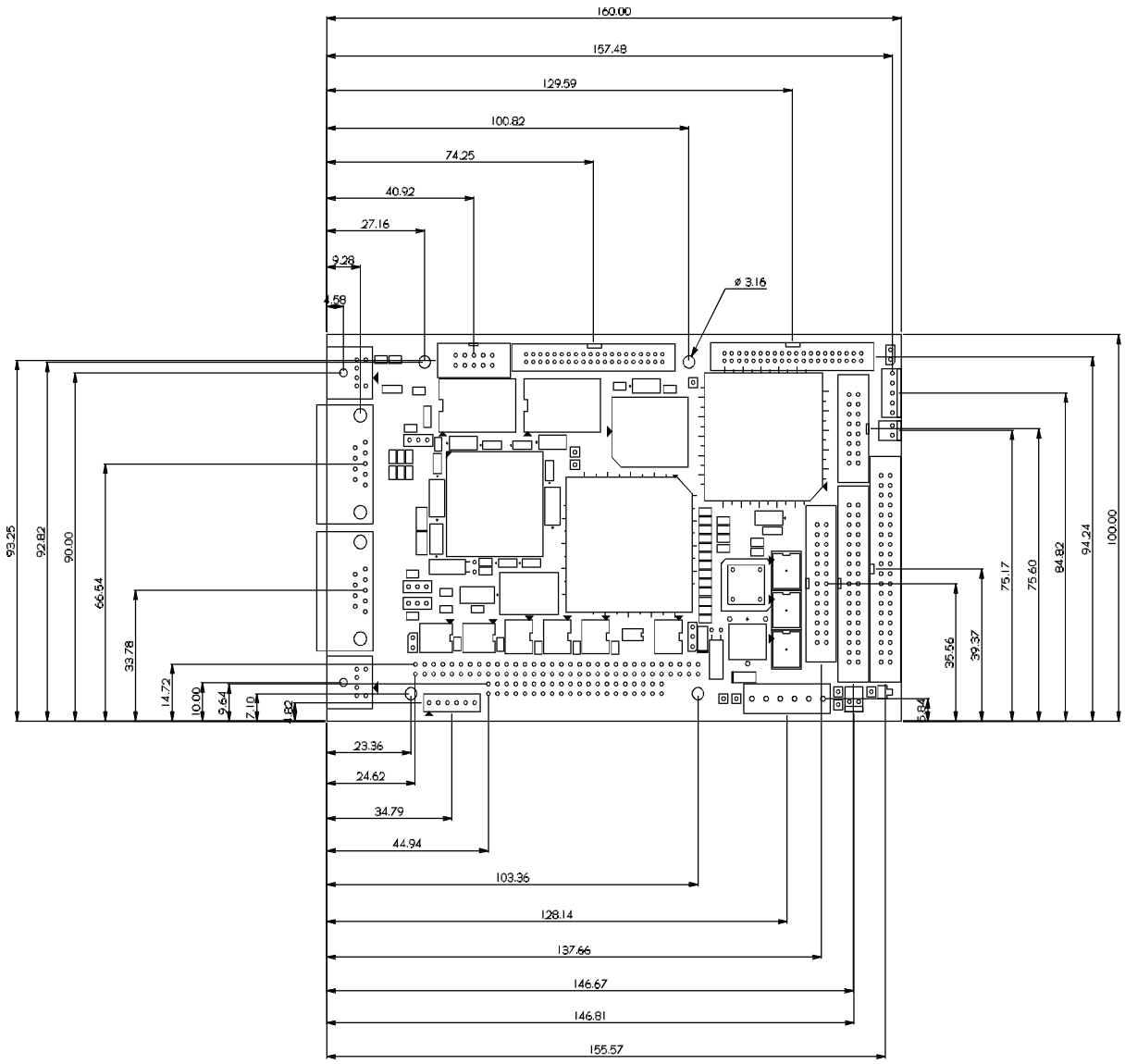


1 RESET I/P
2 GND

Appendix B - Specification

Microcontroller	AMD ELAN SC400 Microcontroller
Speed	100Mhz, 66Mhz, 33Mhz, 16Mhz, 8Mhz, 4Mhz, 2Mhz and 1Mhz options
Memory	4, 8, 16 Mbyte DRAM 4 or 8 Mbyte Flash 128 Kbyte SRAM
VGA Video	Chips and Technology 65545 High Performance Flat Panel / CRT VGA controller 1Mb Video DRAM
MONO LCD Controller	Up to 640x 480 dual-scan
KeyPad Matrix	Maximum of 64 keys (8 x 8)
Peripherals	16550 Compatible UARTS on COM1,2 and 3 RS-232 - COM1 COM3 RS485 - COM2 (half-duplex)
Flash Erases	100,000 per device (minimum)
On-Board Battery	Lithium 170mA Hold-Up time = 15,500hours
Operating temperature range:	-20°C to +70°C without on-board battery fitted 0°C to +65°C with battery fitted
Storage temperature range:	-40°C to +125°C
Power consumption:	1A @+5v maximum (with no power management features)
MTBF	150,000 hours (using generic figures from MIL-HDBK-217F at ground benign):

Appendix C - Mechanical Layout (All dimensions in mm)



Appendix D - Bibliography

AMD ELAN SC400 **User Manual and Register Set**

AMD
One AMD Place
P.O. Box 3453
Sunnyvale
California

http://www.AMD.com

Peripherals **SUPER I/O SMCS FDC37C932**

Kudos Thame Ltd.
Reading, England
Phone: 44-1189-351010
Fax: 44-1189-351030
Email: sales@ktl.memec.como

http://www.SMSC.com

VGA Controller **Chips and Technologies 65545 High Performance Flat Panel / CRT VGA Controller**

Siretta Microelectronics Ltd
Tekelec House
Back Lane
Spencers Wood
Reading
Berks
RG7 1PD

http:\\www.CHIPS.com

ROM-DOS
CardTrick (AFFS) **Datalight**
18810 58th Avenue NE
Arlington
WA 98223

http:\\www.Datalight .com

Appendix E - ROM-DOS Remote Disk Utility

The ROM-DOS Remote Disk Utility is on the utilities disk supplied with the ELAN-104 and allows a remote host PC to transfer files to the ELAN-104 across a serial communications link. This utility is very flexible and makes the downloading of application software easier and more effiecient. The ELAN-104 has the file REMSERV.EXE installed on the on-board Flash. The other files refeered to below can all be found on the utilities disk.

Using ROM-DOS Remote Disk Utility with One Communication Link Application Note for the ELAN-104

The utilities disk contains two batch files, A:\REMSERV\REMOPEN.BAT and A:\REMSERV\REMTERM.BAT, which will open and terminate applications in the correct order to prevent a conflict between applications trying to share the single communication link. A conflict of this kind can cause Windows-based systems to lock-up.

1. Connect a null modem cable between COM1 on the ELAN-104 and an un-used COM port on the host PC.
2. Make a new directory on the host PC (e.g. c:\remdisk\)
3. Copy the following files from the utilities disk to the new directory : a:\remserv\remopen.bat; a:\remserv\remterm.bat; a:\romdos\remdisk.exe; a:\romdos\remquit.exe; a:\choose.exe.
4. Turn on the ELAN-104 and wait until the ELAN-104 has successfully booted.
5. Type:

   ```
   REMSERV c: /B115 /COM1
   ```

   This allows the ELAN-104 to be accessed as a drive on the host PC.
6. Open a DOS prompt box and go to the new directory and run the file REMOPEN. This will prompt you to select the COM port that you are using. A message will appear telling you which drive letter the ELAN-104 Flash Drive has been allocated to. The AUTOEXEC.BAT file on the ELAN-104 and REMOPEN.BAT will configure the Remote Disk utility at 115K baud (the fastest available). Carry out any file copying or editing you need to do to this drive as if it were any other normal hard drive. Note: The Flash Drive will appear slightly slower due to the COM's link.
7. When you have finished copying files run the batch file REMTERM. This will quit the remote server, uninstall the Flash drive from the host PC and exit from the DOS prompt. DO NOT alter these batch files. They have been written specifically to stop windows crashing due to mis-use of the COM ports.
8. If you need to run Remote Disk utility again to copy or edit files simply type

   ```
   REMSERV c: /B115 /COM1
   ```

   on the ELAN-104 and follow the procedure again.